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ABSTRACT

The predictive validity of an original Piagetian instrument (the Piagetian Task Instrument) was compared with that of two frequently used published screening tests for children entering kindergarten: (1) the Brigance K-1 Screen, and (2) the Merrill Language Screening Test. The relative contribution of each test was determined when they were combined with a battery for predicting young children's initial academic success in kindergarten. Subjects were 95 predominantly white, middle-class children (47 boys and 48 girls) without history of developmental difficulties. Subjects' mean age was 60 months. The criterion measure, administered 8 months later, was a teacher's rating scale. Correlation and multiple regression techniques were used to analyze the data. Contrary to the hypothesis, the Piagetian instrument had the lowest predictive validity of the three and contributed least to the regression equation. The predictive validity of the battery was judged too low for use in making decisions about very young children. It is suggested that it is inadvisable to test young children routinely prior to entry into kindergarten. The construct validity of the criterion measure and the predictor measures was discussed. Although the Piagetian test did not display significant predictive capacity, the theoretical base appears to warrant further investigation. (Author/SLD)

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PREDICTIVE VALIDITY OF THREE PRESCHOOL DEVELOPMENTAL ASSESSMENT INSTRUMENTS FOR THE ACADEMIC PERFORMANCE OF KINDERGARTEN STUDENTS

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ABSTRACT

Concern has been expressed in the literature regarding the appropriateness of instruments used to assess entering kindergarten children. The purposes of the present study were (1) to compare the predictive validity of an original Piagetian instrument with two frequently used published screening tests, and (2) to determine the relative contribution of each test when combined into a battery for predicting young children's initial academic success in kindergarten.

The subjects were 95 predominantly white, middle-class children, without any history of developmental difficulties. The mean age was 60 months at the time of the initial testing. The criterion measure, administered eight months later, was a teachers' rating scale. Correlation and multiple regression techniques were used to analyze the data.

Contrary to the hypothesis, the Piagetian instrument was found to have the lowest predictive validity of the three instruments and to contribute least to the regression equation. Also, the predictive validity of the battery was judged to be too low for use in making decisions regarding individual children. The major recommendation for the study was that it is inadvisable to routinely test young children prior to entry into kindergarten.

Concern for the construct validity of the criterion, as well as the predictor measures, was discussed. It was suggested that while the Piagetian test did not display any significant predictive capacity, the theoretical base for Piagetian instruments appears viable to the extent that further research is warranted

INTRODUCTION

There is a moral as well as pedagogical imperative to evaluate fairly. This is all the more compelling when assessing young children in a democratic and culturally diverse society such as the United States. Piaget has provided a theoretical model which indicates that logico-mathematical knowledge may be less influenced by cultural background, socioeconomic factors, and preschool experiences than currently employed general skill and knowledge models. If Piaget's logico-mathematical domain can be assessed using a practical, reliable, valid, and standardized instrument, this might lead to fairer early evaluation, and more developmentally appropriate programs for young children, through a greater understanding by teachers of each child's developmental level. It is hoped that assessment, using Piagetian logico-mathematical knowledge, will reduce the socioeconomic and cultural bias to which some assessments are prone and focus upon development as a more fundamental manifestation of readiness (Dudek, 1969; Book, 1983).

Literature Review

It is the thesis of this paper that an early assessment instrument must have a theoretical basis upon which to rest. Further it is posited that the constructs of Jean Piaget provide such a viable theoretical underpinning.

There are mixed views expressed in the literature regarding the efficacy of using Piagetian items for predicting future academic success. Several authors (Tedenham, 1971; Tadlock, 1986) support the use of Piagetian items. In addition Ginsburg (1972) indicates that Piagetian based assessments, with their more developmental and global nature reduce some of the socioeconomic influence associated with tests which sample specific knowledge domains. Kuhn (1976) believes that Piaget's work may hold promise for more equitable assessment of young children. Elkind (1971), however, sees little value in constructing assessment instruments derived from Piagetian tasks.

Studies involving the use of Piagetian tasks have produced some interesting results. Kaufman (1971) used factor analysis to indicate the contributions that various Piagetian tasks made to predicting achievement. He concluded that, of the tasks he examined, conservation of number, conservation of length, seriation, and classification tasks appeared to be credible predictors of achievement. Dudek (1969) was also interested in the predictive ability of a Piagetian battery. He reported correlation coefficients in the .40's between specific Piagetian items given to kindergarten students and their first-grade success as measured by report card grades assigned by their teachers.

Arlin (1981) attempted to determine if a battery of Piagetian tests would assess cognitive development and thereby reliably predict academic achievement in early reading and mathematics. Her results indicate that a battery of Piagetian items serves as a good predictor of subsequent academic performance.

Over forty years ago Anastasi (1949) stated her belief that test makers need to identify commonalities across cultures and base tests on these factors or to develop instruments within cultures that represent intelligent, adaptive behaviors within specific contexts. Some authors (Charters, 1963; Bernstein, 1974; Labov, 1972) find that evaluation is not always fair to children who are members of ethnic, racial or socioeconomic sub-cultures.

Piagetian theory proposes a series of universal developmental periods in intellectual development with less attention to individual differences. Piaget believed development would occur as a reaction to general experience rather than specific, more culturally and socioeconomically influenced, opportunities. Kuhn (1976) has stated, "Any objects or events in one's environment are as adequate as any others for use in constructing these respective concepts" In concurring with Kuhn's position, Kohlberg (1968) stated that, "Culturally deprived" preschoolers achieved better on

Piagetian than on psychometric instruments."

Based on the belief that a theoretical base is necessary for test construction, an awareness of developmental stages, and concern for socio-cultural diversity the present study was undertaken.

METHOD

Subjects

The subjects were 95 children scheduled to begin attending a suburban Buffalo, N.Y. public school kindergarten in September, 1989. Each of the 47 boys and 48 girls participated in the New York State mandated kindergarten assessment program. The mean age of the children was 60 months at the time of testing, May, 1989. The population was predominantly white middle-class in nature.

Procedure

Three predictor instruments, along with age, were used to predict academic performance in kindergarten. The criterion measure was a teachers' rating scale.

Predictor Measures. The first predictor was a Piagetian Task Instrument (PTI) which was developed for us in the current study to assess the children's cognitive abilities according to Piaget's theory of mental development. Since each question originated in the research of Piaget or his followers, the items are presumed to possess content

validity. Two pilot studies resulted in refinement of the psychometric properties of the final instrument. A brief description of the PTI items along with references is given in Table 1.

INSERT TABLE 1 ABOUT HERE

The PTI test seems especially appropriate in assessing young children because of several features. First, the manipulative materials seemed interesting for children to use as indicated by their willingness to perform the tasks and comply with requests to persevere at some of the tasks. Second, the tests were generally perceived by the subjects to be quite easy, resulting in the children having a feeling of success regardless of the appropriateness of their responses. This attitude seemed to be present even when the "correct" answer was not given and when no points could be awarded.

The PTI was administered to one student at a time by teachers trained in administering the instrument. Each subject's responses were recorded on the PTI score sheet. The scoring of the PTI consists of 13 items scored 0-2. In order to receive a full two points examinee's need to supply a correct response and also deal adequately with the examiner's challenge to the response and to supply an acceptable explanation for their answer. One point is awarded for a correct response not followed by a successful reaction to the

challenge posed by the examiner or an adequate explanation of the examinee's reasoning. No points are awarded for a non-response or an incorrect one.

Of the 95 subjects tested, five were randomly selected for video taping in order to establish inter-rater reliability and agreement (one subject was subsequently eliminated due to failure of technical equipment). The investigator reviewed the tape of the earlier testing sessions and scored the results of the remaining four subjects. The teachers' results were correlated with the investigator's to calculate inter-rater reliability and agreement. Inter-rater reliability was .99 and inter-rater agreement was .88.

The second predictor was the Brigance K-1 Screen (Brigance, 1987). The BKS is one of the instruments used as part of the host school district's kindergarten assessment program each year. It is the instrument used to assess the "broad range of skills and abilities" area of the study. The BKS was developed to provide a quickly administered assessment of overall development in five basic areas: language development, motor ability, number skill, body awareness, and auditory and visual discrimination. Teachers trained in administering the test conducted the evaluation.

The publishers of the BKS state that the test is criterion referenced and that it possess content validity. An

examination of the BKS items indicates that they encompass the skills and abilities that are generally considered requisite for entering kindergartners. Sax's (1980, p. 291) criteria for content validity, "Tests have content validity if the behavior and subject matter called for in the items correspond to the behavior and subject matter identified in the specific objective," appear to have been met. An internal reliability of .91 for the BKS was calculated by Messers, Enright, and Linkous (1985) using Cronbach's coefficient alpha on the total set of items using data from 8,172 subjects.

A third predictor, the Merrill Language Screening Test (Mumm, Secord and Dykstra, 1980) was used to assess the language development of the subjects in this study. The MSLT is one of the standardized instruments chosen by the school district as part of the mandated prekindergarten screening program. The MSLT was constructed to sample four specific areas of linguistic competence: pragmatics, syntax, semantics, and phonology. Since the MSLT has previously been used in the screening procedure of the host school district, and since it possesses acceptable reliability and validity characteristics, it was one of the instruments used in the current study. Results of the MSLT were recorded by a speech therapist trained in administration and scoring of this text.

The final predictor variable was the chronological age of each subject.

Criterion Measure. Academic performance in kindergarten was rated by a Teachers' Rating Scale (TRS) which was an adaptation of the school district's report card. Each of 15 items shown in Figure 1 was rated by the child's kindergarten teacher using the code: 1 (low) to 5 (high) as suggested by Sharp and Edgar (1986) and Simner (1988). This resulted in a scoring range of 15 to 75 for the fifteen items on the scale.

INSERT FIGURE 1 ABOUT HERE

The descriptive criteria displayed in Figure 2 were supplied and explained to each teacher by the investigator who was also present to answer questions during the rating procedures.

INSERT FIGURE 2 ABOUT HERE

The ratings were compiled by the kindergarten teachers in January, 1990 for students completing the first half of their kindergarten year. The steps in the rating procedure closely follow those used by Bolig and Fletcher (1973) in which each item was rated for every subject before continuing to the next item.

RESULTS

Reliability

The reliability of the predictors in the present study were determined by coefficient alpha. They were: PTI = .75; BKS = .74; MSLT = .82; TRS = .96.

Predictive Validity

The Pearson product-moment coefficient of correlation was used to determine the relationships between the respective predictor variables (PTI, BKS, MSLT, age) and the criterion of Teachers' Rating Scale (TRS). These relationships are displayed in Table 2.

INSERT TABLE 2 ABOUT HERE

As indicated in Table 2, the PTI does not reliably predict kindergarten children's performance on the criterion measure. The Pearson coefficient of correlation for the PTI with the TRS is .12, which is not significantly different from chance.

There is a statistically significant relationship between the BKS predictor variable and the TRS criterion variable. The Pearson correlation coefficient is .50. The coefficient of determination is .25, which indicates the BKS predicts 25% of the variance of the TRS.

A statistically significant relationship was also found between the MSLT and the criterion variable. The MSLT correlates .41 with TRS. This yields a coefficient of determination of .17.

The relationship between age and TRS was .25, which is statistically significant and yields a coefficient of determination of .06. This means 6% of the variance in the TRS is predicted by age. This is not practically significant.

Combining Predictor Effect

Taken individually, none of the predictor variables are strong predictors of the criterion. While most display statistically significant relationships their coefficients of determination indicate a generally low predictive capacity. In order to determine what affect combining the predictor instruments will have on predicting the outcome measure a multiple regression analysis was performed.

The BKS has the highest correlation coefficient at .50, with TRS. Therefore, the BKS was the first predictor entered into the multiple regression equation. The next largest correlation coefficient was MSLT at .41. This was the next entry into the regression equation. These entries were followed by age (.25) and PTI (.12). The results of the stepwise multiple correlation are shown in Table 3.

INSERT TABLE 3 ABOUT HERE

The BKS is the primary contributor to predicting academic success in kindergarten as measured by the Teachers' Rating Scale (TRS). The BKS alone predicts 25% of the variance of the TRS. The next best predictor is the MSLT which, when added to the regression equation, raises the percent of variance that can be predicted by the BKS and MSLT combined from 25% to 29%, which is a statistically significant increase. Adding PTI score and age predictors beyond the first two variables does not significantly increase the prediction of TRS variance.

In review, it was posited in the present study that the PTI would measure constructs of a mathematical and logical nature. The position was taken that such underlying constructs would be reliably and validly measured by the PTI test and that the PTI would be the single best predictor of early academic success in kindergarten. The hypothesis must be regarded as untenable. The best predictor, as indicated by the data collected, is the BKS, followed by the MSLT which also made a significant contribution. Age and the PTI's contribution to prediction were negligible.

With all predictor variables combined, the multiple regression is .55 with a coefficient of determination of .30. This indicates that BKS, MSLT, Age and PTI combine to predict

less than one-third of the variance of the TRS.

DISCUSSION

The results of the present investigation indicate that contrary to the initial hypothesis, the PTI appears to be a poor predictor of academic achievement as measured by teachers' ratings for he subjects involved. Three possible explanations are suggested to account for this finding: (1) The PTI is simply a poor predictor of academic performance in kindergarten; (2) A mismatch exists between what the PTI measures, presumably logico-mathematical knowledge, and the curricular emphasis of the kindergarten teachers; and (3) The Teachers' Rating Scale is an inadequate criterion for assessing academic success.

Regarding the first possibility - that the PTI is a poor test - this conclusion would stand in opposition to the findings of Bergling (1974), Arlin (1981), and Kingman and Koop (1983), who all concluded that Piagetian tasks are good predictors of later achievement.

Also, a substantial body of literature accumulated over a fairly long period of time indicates that numerous developmental constructs have been validated using Piagetian tasks. These constructs form the basis of Piagetian theory. It would, therefore, be erroneous to conclude that Piagetian tasks, in general, are simply poor means of assessment. If

the theory is viable, and Piagetian tasks assess the constructs comprising the theory, (Light and Gilmore, 1983; Carroll and Stewart, 1984; Goldbeck, 1985) and if the PTI utilizes important cognitive constructs (Fogelman, 1970; Mori, 1976; Voyat, 1982), but still the PTI does not predict academic success in kindergartens it may be argued that it is the curriculum and not Piagetian assessment, that may be challengeable.

This introduces the second possibility - that a mismatch exists between curricular expectations and Piagetian measurement. The correlation, or shared variance, between the PTI and the TRS indicates that the PTI and teachers' ratings are assessing largely different domains. Such a finding involving a Piagetian instrument is similar to that of Vacc, Vacc, and Fogelman (1987), Telegedy (1973), Bolig and Fletcher (1973), and Sharpley and Edgar (1986) all of whom concluded that standardized achievement tests and teacher ratings tap different domains.

An instrument that has as its goal the assessment of some fundamental dimension of cognitive development such as logico-mathematical reasoning, will not be congruent with curricula that focus on the kind of knowledge Piaget referred to as, "social-arbitrary" (Wadsworth, 1986). One explanation for such a lack of congruence may be that typical school programs are not directed toward nurturing cognitive

development or reasoning ability. Therefore, Piagetian tasks and instruments will fail to predict success when success is operationally defined as achievement within skill and fact oriented curricula.

Regarding the third possibility - that teachers' rating scales are poor criterion measures - it must be recalled that many achievement inventories, including report cards, teachers' rating scales, and early achievement tests are developed from content analyses of classroom materials and practices (Sax, 1974). Much of this content is embedded within the dominant culture and is skill and fact oriented with a strong dependence upon language facility and prior knowledge. Conversely, "Piagetian tests primarily assess reasoning ability" (Elkind, 1986). If a dichotomy is maintained between traditional skill-and-fact oriented curricula and the reasoning orientation of a PTI, then a lack of significant shared variance should not be unexpected.

If understanding logico-mathematical relationships is valued less than is rote counting, then rote counting will emerge as a measure of success. Therefore, a test assessing relationships will not be found to possess high validity when the measure of success is rote number recall. If conceptualizing the Piagetian constructs of speed, quantity, or spatial relationships are not accorded the same status as

naming colors, shapes, and letter sounds, then a test that assesses the former concepts will appear to lack predictive validity.

CONCLUSION

The major conclusion of this study is that it is inadvisable to routinely test young children prior to or immediately after their entry into kindergarten. Divorky (1971), Labov (1972), Slazer (1986), and Martin (1988) have expressed support for refraining from such early evaluations. This conclusion is drawn for several reasons.

First, the data from the present investigation indicate that a commonly sued kindergarten screening instrument (BKS), which was the greatest contributor to criterion prediction in the present study, predicted only 25% of the variance pertaining to later teacher assessment unpredicted. Adding a language assessment instrument (MSLT) increased the predicted variance to 29%. This leaves 71% of the variance unpredicted.

Second, the unrestricted use of early assessments may reinforce the tendency for tests to move kindergarten curricula in developmentally inappropriate directions. Forces may be felt by teachers, either external or internal, that lead to direct instruction of fragmented skills.

Third, the affective and psychomotor domains may be deemphasized in order to concentrate on the cognitive domain. Even within the cognitive area, thinking, problem solving,

creativity, and cooperative enterprise may be reduced in order to allow time for drill and practice in areas that will be specifically evaluated by report card categories.

Finally, the potential for the "self-fulfilling prophesy" (Rosenthal and Jacobson, 1968; Brophy, 1983) exists. This possibility becomes problematic to whatever extent that early assessment automatically leads to homogeneous class assignment, referrals to remedial programs, or teacher acceptance of conclusions based on tests with reliability insufficient for decision making concerning individual children, and/or questionable predictive validity.

LIMITATIONS AND RECOMMENDATIONS FOR FURTHER STUDY

The limitations of the current study suggest areas for further research. One limitation of this study is the choice of criterion measures. If criteria are inappropriate then instruments which correlate highly with such criteria are accurate but inappropriate. It is possible that predictor variables having weak relationships with the outcome measures, may be assessing more significant constructs. The use of additional criterion measure such as Stanford Achievement Test, the Cognitive Abilities Test (Part Two), the Torrance Creativity Test and I.Q. tests may have yielded useful data by assessing other domains of interest.

A second limitation of the present study is the restricted socioeconomic range of the subjects. As judged by the general composition of the community in terms of income, housing, and level of education, the socioeconomic status of the children's families was predominantly middle class. Therefore, it is recommended that research similar to tne present investigation by conducted using a more varied population. A spectrum of racial, ethnic, and socio-economic subjects would serve as appropriate populations for such future studies.

Finally, it is suggested that longitudinal continuation of the present study (with appropriate modifications as suggested above) be conducted.

Table 1
List of PTI Items

ITEM	PIAGETIAN CONSTRUCT	TASK TYPE	REFERENCE
1	Conservation of Number	Spreading counters	Fogelman (1970) Starkey (1981)
2	Conservation of Number	Beads in containers	Voyat (1982) Kaplan (1982)
3	Conservation of Liquids	Water in containers	Fogelman (1970)
4	Conservation of Length	Dowels	Voyat (1982) Kaufman (1971)
5	Conservation of Length	Pipe cleaners	Schwebel & Raph (1973)
6	Conservation of Substance	Clay balls	Sheldon & Wynn (1987)
7	Seriation	Piles of chips	Wadsworth (1986)
8	Seriation	Ordering dowels	Bart & Airasian (1974) Arlin (1981)
9	Classification	Two-way Matrix	Bart & Airasian (1974) Arlin (1981)
10	Transformation	Rotation (balls)	Dudek (1969) Wadsworth (1978)
11	Topological Space	Dot: Curve	Dodwell (1968) Gruber & Voneche (1977)
12	Euclidean space	Figure within figure	Voyat (1982) Gruber & Voneche (1977)
13	Speed	Two cars on tracks	Wadsworth (1984)

Figure 1

Teacher Rating Scale

Language Development

1. Expresses thoughts in complete sentences.
2. Uses appropriate speech and speech patterns.
3. Comprehends oral language.
4. Relates ideas in sequence.
5. Identifies auditory likenesses and differences.

Mathematics

6. Counts objects up to ten.
7. Recognizes numerals from zero to ten.
8. Writes numerals from zero to ten.
9. Identifies basic geometric shapes: square, circle, and triangle.
10. Understands positional terms: over, under, between and next to:

Literacy

11. Recognizes 20 upper and lower case letters.
12. Prints each of 20 upper and lower case letter as named.
13. Possesses ability to demonstrate letter sounds.
14. Demonstrates front to back orientation of books.
15. Demonstrates left to right progression in print.

Figure 2

Criteria Reference

1 = Unsatisfactory performance. Inability of the student to perform beyond a minimal level according to the descriptive criteria.

2 = Below the performance level of the average kindergarten child. Limited growth demonstrated.

3 = Average performance for a kindergarten child. Learning has taken place with teacher guidance. Criterion has been successfully met.

4 = Above the performance level of the average kindergarten child. Criterion has been successfully attained and applied.

5 = Superior performance. Criterion has been met with ease and has been successfully applied.

Table 2

Correlation of Predictor Variables with Teachers' Rating Scale

	r	r^2	p
PTI	.12	.01	.135
BKS	.50	.25	.000**
MSLT	.41	.17	.000**
Age	.25	.07	.008**

Note. ** = significant, < .01.

Table 3

Stepwise Multiple Correlation Coefficients for Predictor Variables with the TRS criterion Variable

Variable	R	R^2	SE	Increase in R	Increase in R^2	F	P
X_1 BKS	.50	.25	11.45	--	--	28.51	.000**
X_2 MSLT	.54	.29	11.21	.04	.04	4.99	.028*
X_3 Age	.55	.30	11.15	.01	.01	1.93	.168
X_4 PTI	.55	.30	11.19	.00	.00	.29	.593

Note. * = < .05 level of significance

** = < .01 level of significance

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